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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/684,522	10/15/2003	Young-Dong Lee	030681-578	4190

21839 7590 07/27/2006

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POST OFFICE BOX 1404
ALEXANDRIA, VA 22313-1404

EXAMINER	
ALEJANDRO MULERO, LUZ L	

ART UNIT	PAPER NUMBER
1763	

DATE MAILED: 07/27/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/684,522	LEE ET AL.	
	Examiner	Art Unit	
	Luz L. Alejandro	1763	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *04 May 2006*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-3,9-21 and 25-32* is/are pending in the application.

4a) Of the above claim(s) *26* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-3, 9-21, 25, 27-32* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *0406*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

Applicant's election with traverse of Specie A, claims 1-3, 9-11, 13-21, and 27-31 in the reply filed on 05/04/06 is acknowledged. The traversal is on the ground(s) that a first action on the merits has already been issued and therefore there is no serious burden on the Examiner. This is not found persuasive because the restriction requirement was made in response to the amendment that applicant made to the claims after the first action was issued. Furthermore, since two different embodiments of the invention were newly presented in the amendment to the claims, there is serious burden on the examiner.

The requirement is still deemed proper and is therefore made FINAL.

Claim 26 is withdrawn from further consideration pursuant to 37 CFR 1.142(b), as being drawn to a nonelected specie, there being no allowable generic or linking claim.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 1-3, 9-21, 25 and 27-31 rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably

convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. The specification, as filed, does not describe a **continuous** circular coil as claimed in claim 1-line 11; claim 14, lines 2-3; claim 27-line 3; claim 28-line 9; claim 29, line 2; claim 29-line 4; claim 29-line 3; claim 29-line 4; claim 31-line 2; and claim 31-line 4. Additionally, the specification, as filed, does not describe a **continuous** serpentine coil as claimed in claim 1-line 10; claim 27-line 2; claim 28-line 10; claim 29-line 2; claim 29-line 5

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1 and 9-11 are rejected under 35 U.S.C. 102(e) as being anticipated by Wang et al., US 2003/0111181.

Wang et al. shows the invention as claimed including an inductively coupled plasma generating apparatus comprising: an evacuated reaction chamber; an antenna installed at an upper portion of the reaction chamber to induce an electric field for ionizing reaction gas supplied into the reaction chamber and generating plasma; and an radio frequency power source connected to the antenna to apply radio frequency power

to the antenna, wherein the antenna comprises a plurality of coils 910/920/930 comprising a first continuous serpentine coil and a second continuous circular coil, wherein the serpentine coil is bent in a zigzag pattern and surrounds the circular coil (see figs. 1-2 and 9 and their descriptions—note that the coils of fig. 9 can be replaced by one of the coils of figs. 1-2 or 5-8).

Concerning claim 3, the circular coil has a relatively small radius to reduce the area of opposing portions between the circular coil and the serpentine coil.

Regarding claim 9, the serpentine coil has a zigzag pattern with equally spaced interval sections.

With respect to claims 11-12, the inner and outer portions of the serpentine coil are arranged to correspond to center and edge portions of the chamber, respectively, and the plurality of coils are connected by connection coils that are placed high above a plane where the plurality of coils are arranged.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 2-3, 12, 25, 27-32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wang et al., US 2003/0111181 in view of Nishikawa et al., US

6,244,211, Howald et al., US 2004/0124779, Chen et al., US 6,164,241, Holland, US 6,319,355 or Takagi, US 5,681,393.

Wang et al. is applied as above but do not expressly disclose that the circular coil and the serpentine coil are connected by at least a connection coil. Nishikawa et al., disclose an inductive plasma apparatus in which two coils are connected by a connection coil 73 (see, for example, fig. 9 and its description). Also, Howald et al., disclose an inductive plasma apparatus in which two coils are connected by a connection coil 174 (see, for example, fig. 2 and its description). Furthermore, Chen et al., disclose an inductive plasma apparatus in which two coils are connected by a connection coil (see, for example, fig. 3 and its description). Additionally, Holland et al. disclose an inductive plasma apparatus in which plurality of coils are connected by connection coils 72/78/82 (fig. 2) or connection coil 64 (fig. 3), see, for example, figs. 2-3 and their descriptions. Moreover, Takagi et al., disclose an inductive plasma apparatus in which two coils are connected by a connection coil 521b (see, for example, fig. 20 and its description). Therefore, in view of these disclosures, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the apparatus of Wang et al. as to connect the circular coil and the serpentine coil by at least a connection coil because such structure is used and known in the art to be suitable for connecting two coils in order to achieve a desired plasma density over the inductive plasma apparatus.

Concerning claim 3, note that the circular coil of the apparatus of Wang et al. modified by Nishikawa et al., Howald et al., Chen et al., Holland et al. and Takagi et al.,

has a relatively small radius to reduce the area of opposing portions between the circular coil and the serpentine coil.

With respect to claim 27, it would have been an obvious choice of design to one having ordinary skill in the art at the time the invention was made to connect the serpentine continuous first portion to the RF power source at the end away from the circular continuous second portion, and to connect the circular continuous second portion to ground at the end away from the serpentine continuous first portion.

Claims 13-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wang et al., US 2003/0111181.

Wang et al. is applied as above but does not expressly disclose the particular shape of the coils. However, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Wang et al. as to have the coil in the desired shape because the configuration of the claimed coils is a matter of choice which a person of ordinary skill in the art would have found obvious absent persuasive evidence that the particular configuration of the claimed coils is significant.

Claims 15-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wang et al., US 2003/0111181 in view of Hemker et al., US 2004/0011467 or Bailey, III et al., US 2003/0010454.

Wang et al. is applied as above but do not expressly disclose the claimed magnetic configuration. Hemker et al. discloses a plurality of permanent magnets 132

arranged around the outer wall of the reaction chamber, wherein their north and south poles alternate, they are arranged in a region where the magnitude of a magnetic field generated by the antenna is relatively weak, and the magnets can revolve simultaneously about a central axis of the reaction chamber to shift their positions (see figs. 1-6c and their descriptions). Alternatively, Bailey, III et al. also discloses the claimed structure (see figs. 2, 3A-4, and 6 and their descriptions). In view of these disclosures, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Wang et al. so as to include the magnetic structure of Hemker et al. or Bailey, III et al. because such a magnetic configuration allows for modification of the plasma as well as allowing the plasma to be better confined to the processing region.

Claims 19-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wang et al., US 2003/0111181 in view of Kwon et al., U.S. Patent 6,653,988 or Chen et al., US 6,164,241.

Wang et al. is applied as above but does not expressly disclose a capacitor connected between the matching network and the antenna, in parallel with the antenna, wherein the plurality of coils are connected in series to the radio frequency power source, and wherein at least one of the coils is connected in parallel to the RF source. Kwon et al. discloses a capacitor C3 connected between the matching network 120 and the antenna, in parallel with the other branch from the power supply connecting with the antenna, wherein the plurality of coils are connected in series to the radio frequency

power source 110, and wherein at least one of the coils is connected in parallel to the RF source (see fig. 2a and its description). Furthermore, Chen et al. discloses a matching network 320 connected between a radio frequency power source 310 and the antenna 1 and a capacitor C1 connected between the matching network and the antenna, in parallel with the antenna, wherein the plurality of coils are connected in series to the radio frequency power source, and wherein at least one of the coils is connected in parallel to the RF source (see, for example, fig. 3 and its description. Therefore, in view of these disclosures, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Wang et al. modified by Wang et al. or Okumura et al. so as to comprise the matching network/rf power source/capacitor/antenna structure of Kwon et al. or Chen et al. because in such a way a suitable parallel resonance antenna can be operated.

Claims 1, 9-11, 13-17, 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ishii et al., U.S. Patent 5,938,883 in view of Wang et al., US 2003/0111181 or Okumura et al., US 6,177,646.

Ishii et al. shows the invention substantially as claimed including an inductively coupled plasma generating apparatus comprising: an evacuated reaction chamber; an antenna installed at an upper portion of the reaction chamber to induce an electric field for ionizing reaction gas supplied into the reaction chamber and generating plasma; and a radio frequency power source connected to the antenna to apply radio frequency power to the antenna, wherein the antenna comprises a plurality of coils comprising a

first continuous serpentine coil 24A and a second continuous circular coil 24B, wherein the serpentine coil surrounds the circular coil (see, for example, fig. 10 and its description).

Ishii et al. does not expressly disclose that the serpentine coil is bent in a zigzag pattern. Wang et al. disclose an inductive coupled plasma apparatus in which a serpentine coil is bent is a zigzag pattern (see, for example, figs. 1-2, 5-10, and their descriptions). Additionally, Okumura et al. discloses an inductive coupled plasma apparatus in which a serpentine coil is bent is a zigzag pattern (see, for example, figs. 3, 14-16 and 21, and their descriptions). Therefore, in view of these disclosures, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the apparatus of Ishii et al. as to comprise a serpentine coil bent in a zigzag pattern because such coil is used and known to be suitable for generating uniform plasma in an inductive plasma apparatus. Furthermore, the configuration of the claimed serpentine coil is a matter of choice which a person of ordinary skill in the art would have found obvious absent persuasive evidence that the particular configuration of the claimed serpentine coil is significant.

With respect to claims 9-11, note that the serpentine coil of the apparatus of Ishii et al. modified by Wang et al. or Okumura et al., has a zigzag pattern with equally spaced several sections, has a plurality of outer portions extending along the circumference and a plurality of inner portions bent toward the center portion. Furthermore, the inner and outer portions of the serpentine coil are arranged to correspond to center and edge portions of the chamber, respectively.

With respect to claims 13-14, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the apparatus of Wang et al. as to have the coil in the desired shape because the configuration of the claimed coils is a matter of choice which a person of ordinary skill in the art would have found obvious absent persuasive evidence that the particular configuration of the claimed coils is significant.

Concerning, claims 15-17, Ishii et al. further discloses a plurality of permanent magnets 42 arranged around the outer wall of the reaction chamber, wherein their north and south poles alternate, they are arranged in a region where the magnitude of a magnetic field generated by the antenna is relatively weak, (see, for example, figs. 11 and 13 and their descriptions).

With respect to claim 27, note that the serpentine continuous first portion is connected to the RF power source at the end away from the circular continuous second portion, and wherein the circular continuous second portion is connected to ground at the end away from the serpentine continuous first portion.

Claims 2-3, 12, 25, 28-32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ishii et al., U.S. Patent 5,938,883 in view of Wang et al., US 2003/0111181 or Okumura et al., US 6,177,646, as applied to claims 1, 9-11, 13-17 and 27 above, and further in view of Nishikawa et al., US 6,244,211, Howald et al., US 2004/0124779, Chen et al., US 6,164,241, Holland, US 6,319,355 or Takagi, US 5,681,393.

Ishii et al., Wang et al. and Okumura et al. are applied as above but do not expressly disclose that the circular coil and the serpentine coil are connected by at least a connection coil. Nishikawa et al., disclose an inductive plasma apparatus in which two coils are connected by a connection coil 73 (see, for example, fig. 9 and its description). Also, Howald et al., disclose an inductive plasma apparatus in which two coils are connected by a connection coil 174 (see, for example, fig. 2 and its description). Furthermore, Chen et al., disclose an inductive plasma apparatus in which two coils are connected by a connection coil (see, for example, fig. 3 and its description). Additionally, Holland et al. disclose an inductive plasma apparatus in which plurality of coils are connected by connection coils 72/78/82 (fig. 2) or connection coil 64 (fig. 3), see, for example, figs. 2-3 and their descriptions. Moreover, Takagi et al., disclose an inductive plasma apparatus in which two coils are connected by a connection coil 521b (see, for example, fig. 20 and its description). Therefore, in view of these disclosures, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the apparatus of Ishii et al. modified by Wang et al. or Okumura et al. as to connect the circular coil and the serpentine coil by at least a connection coil because such structure is used and known in the art to be suitable for connecting two coils in order to achieve a desired plasma density over the inductive plasma apparatus.

Concerning claim 3, note that the circular coil of the apparatus of Ishii et al. modified by Wang et al. or Okumura et al. and Nishikawa et al., Howald et al., Chen et

al., Holland et al. or Takagi et al., has a relatively small radius to reduce the area of opposing portions between the circular coil and the serpentine coil.

Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ishii et al., U.S. Patent 5,938,883 in view of Wang et al., US 2003/0111181 or Okumura et al., US 6,177,646, as applied to claims 1, 9-11, 13-17 and 27 above, and further in view of Hemker et al., US 2004/0011467 or Bailey, III et al., US 2003/0010454.

Ishii et al., Wang et al. and Okumura et al. are applied as above but do not expressly disclose that the magnets can revolve simultaneously about a central axis of the reaction chamber to shift their positions.. Hemker et al. discloses a plurality of permanent magnets 132 arranged around the outer wall of the reaction chamber, wherein their north and south poles alternate, they are arranged in a region where the magnitude of a magnetic field generated by the antenna is relatively weak, and the magnets can revolve simultaneously about a central axis of the reaction chamber to shift their positions (see figs. 1-6c and their descriptions). Alternatively, Bailey, III et al. also discloses the claimed structure (see figs. 2, 3A-4, and 6 and their descriptions). In view of these disclosures, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Ishii et al. modified by Wang et al. or Okumura et al. so as to comprise the magnet revolving structure of Hemker et al. or Bailey, III et al. because such a magnetic configuration allows for modification of the plasma as well as allowing the plasma to be better confined to the processing region.

Claims 19-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ishii et al., U.S. Patent 5,938,883 in view of Wang et al., US 2003/0111181 or Okumura et al., US 6,177,646, as applied to claims 1, 9-11, 13-17 and 27 above, and further in view of Kwon et al., U.S. Patent 6,653,988 or Chen et al., US 6,164,241.

Ishii et al., Wang et al. or Okumura et al. are applied as above, and Ishii et al. further discloses a capacitor 26A/26B connected, but do not expressly disclose a matching network connected between the radio frequency power source and the antenna and a capacitor connected between the matching network and the antenna, in parallel with the antenna, wherein the plurality of coils are connected in series to the radio frequency power source, and wherein at least one of the coils is connected in parallel to the RF source. Kwon et al. discloses a capacitor C3 connected between a matching network 120 and the antenna, in parallel with the other branch from the power supply connecting with the antenna, wherein the plurality of coils are connected in series to the radio frequency power source 110, and wherein at least one of the coils is connected in parallel to the RF source (see fig. 2a and its description). Furthermore, Chen et al. discloses a matching network 320 connected between a radio frequency power source 310 and the antenna 1 and a capacitor C1 connected between the matching network and the antenna, in parallel with the antenna, wherein the plurality of coils are connected in series to the radio frequency power source, and wherein at least one of the coils is connected in parallel to the RF source (see, for example, fig. 3 and its description. Therefore, in view of these disclosures, it would have been obvious to one

of ordinary skill in the art at the time the invention was made to modify the apparatus of Ishii et al. modified by Wang et al. or Okumura et al. so as to comprise the matching network/rf power source/capacitor/antenna structure of Kwon et al. or Chen et al. because in such a way a suitable parallel resonance antenna can be operated.

Claims 1-3, 9-14, 25, and 27-32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nishikawa et al., U.S. Patent 6,244,211 in view of Wang et al., US 2003/0111181 or Okumura et al., US 6,177,646.

Nishikawa et al. shows the invention substantially as claimed including an inductively coupled plasma generating apparatus comprising: an evacuated reaction chamber; an antenna installed at an upper portion of the reaction chamber to induce an electric field for ionizing reaction gas supplied into the reaction chamber and generating plasma; and a radio frequency power source connected to the antenna to apply radio frequency power to the antenna; wherein the antenna comprises a plurality of coils comprising a first coil 72 and a second continuous circular coil 71 wherein the first coil surrounds the circular coil, (see, for example, fig. 9 and its description).

Nishikawa et al. does not expressly disclose that the first coil is a serpentine coil bent in a zigzag pattern. Wang et al. disclose an inductive coupled plasma apparatus in which a serpentine coil is bent is a zigzag pattern (see, for example, figs. 1-2, 5-10, and their descriptions). Additionally, Okumura et al. disclose an inductive coupled plasma apparatus in which a serpentine coil is bent is a zigzag pattern (see, for example, figs. 3, 14-16 and 21, and their descriptions). Therefore, in view of these disclosures, it

would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the apparatus of Nishikawa et al. as to comprise a serpentine coil bent in a zigzag pattern because such coil is used and known to be suitable for generating uniform plasma in an inductive plasma apparatus. Furthermore, the configuration of the claimed serpentine coil is a matter of choice which a person of ordinary skill in the art would have found obvious absent persuasive evidence that the particular configuration of the claimed serpentine coil is significant.

With respect to claims 2-3 and 12, the circular coil is arranged at a center portion of the antenna and the serpentine coil is arranged around and connected to the circular coil by a connection coil 73; the circular coil has a relatively small radius to reduce the area of opposing portions between the circular coil and the serpentine coil.

With respect to claims 9-11 and 27, note in the apparatus of Nishikawa et al. modified by Wang et al. or Okumura et al., the serpentine coil of has a zigzag pattern with equally spaced several sections, the serpentine coil has a plurality of outer portions extending along the circumference and a plurality of inner portions bent toward the center portion, and the serpentine coil is connected to the RF power source at the end away from the circular continuous second portion and the circular continuous second portion is connected to ground at the end away from the serpentine continuous first portion. Furthermore, the inner and outer portions of the serpentine coil are arranged to correspond to center and edge portions of the chamber, respectively.

With respect to claims 13-14, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the apparatus of Wang et al.

as to have the coil in the desired shape because the configuration of the claimed coils is a matter of choice which a person of ordinary skill in the art would have found obvious absent persuasive evidence that the particular configuration of the claimed coils is significant.

Claims 15-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nishikawa et al., U.S. Patent 6,244,211 in view of Wang et al., US 2003/0111181 or Okumura et al., US 6,177,646, as applied to claims 1-3, 9-14, 25, and 27-32 above, and further in view of Hemker et al., US 2004/0011467 or Bailey, III et al., US 2003/0010454.

Nishikawa et al., Wang et al. and Okumura et al. are applied as above but do not expressly disclose the claimed magnetic configuration. Hemker et al. discloses a plurality of permanent magnets 132 arranged around the outer wall of the reaction chamber, wherein their north and south poles alternate, they are arranged in a region where the magnitude of a magnetic field generated by the antenna is relatively weak, and the magnets can revolve simultaneously about a central axis of the reaction chamber to shift their positions (see figs. 1-6c and their descriptions). Alternatively, Bailey, III et al. also discloses the claimed structure (see figs. 2, 3A-4, and 6 and their descriptions). In view of these disclosures, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Nishikawa et al. modified by Wang et al. or Okumura et al. so as to comprise the magnet revolving structure of Hemker et al. or Bailey, III et al. because such a magnetic

configuration allows for modification of the plasma as well as allowing the plasma to be better confined to the processing region.

Claims 19-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nishikawa et al., U.S. Patent 6,244,211 in view of Wang et al., US 2003/0111181 or Okumura et al., US 6,177,646, as applied to claims 1-3, 9-14, 25, and 27-32 above, and further in view of Kwon et al., U.S. Patent 6,653,988 or Chen et al., US 6,164,241.

Nishikawa et al., Wang et al. or Okumura et al. are applied as above but do not expressly disclose a matching network connected between the radio frequency power source and the antenna and a capacitor connected between the matching network and the antenna, in parallel with the antenna, wherein the plurality of coils are connected in series to the radio frequency power source, and wherein at least one of the coils is connected in parallel to the RF source. Kwon et al. discloses a capacitor C3 connected between a matching network 120 and the antenna, in parallel with the other branch from the power supply connecting with the antenna, wherein the plurality of coils are connected in series to the radio frequency power source 110, and wherein at least one of the coils is connected in parallel to the RF source (see fig. 2a and its description). Furthermore, Chen et al. discloses a matching network 320 connected between a radio frequency power source 310 and the antenna 1 and a capacitor C1 connected between the matching network and the antenna, in parallel with the antenna, wherein the plurality of coils are connected in series to the radio frequency power source, and wherein at least one of the coils is connected in parallel to the RF source (see, for example, fig. 3

and its description. Therefore, in view of these disclosures, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Nishikawa et al. modified by Wang et al. or Okumura et al. so as to comprise the matching network/rf power source/capacitor/antenna structure of Kwon et al. or Chen et al. because in such a way a suitable parallel resonance antenna can be operated.

Claims 1-3, 9-14, 25, and 27-32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Howald et al., US 2004/0124779 in view of Wang et al., US 2003/0111181 or Okumura et al., US 6,177,646.

Howald et al. shows the invention substantially as claimed including an inductively coupled plasma generating apparatus comprising: an evacuated reaction chamber; an antenna installed at an upper portion of the reaction chamber to induce an electric field for ionizing reaction gas supplied into the reaction chamber and generating plasma; and a radio frequency power source connected to the antenna to apply radio frequency power to the antenna, wherein the antenna comprises a plurality of coils comprising a first coil 164 and a second continuous circular coil 162 wherein the first coil surrounds the circular coil, (see, for example, figs 1-2 and theirdescription).

Howald et al. does not expressly disclose that the first coil is a serpentine coil bent in a zigzag pattern. Wang et al. disclose an inductive coupled plasma apparatus in which a serpentine coil is bent is a zigzag pattern (see, for example, figs. 1-2, 5-10, and their descriptions). Additionally, Okumura et al. disclose an inductive coupled plasma

apparatus in which a serpentine coil is bent is a zigzag pattern (see, for example, figs. 3, 14-16 and 21, and their descriptions). Therefore, in view of these disclosures, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the apparatus of Howald et al. as to comprise a serpentine coil bent in a zigzag pattern because such coil is used and known to be suitable for generating uniform plasma in an inductive plasma apparatus. Furthermore, the configuration of the claimed serpentine coil is a matter of choice which a person of ordinary skill in the art would have found obvious absent persuasive evidence that the particular configuration of the claimed serpentine coil is significant.

With respect to claims 2-3 and 12, the circular coil is arranged at a center portion of the antenna and the serpentine coil is arranged around and connected to the circular coil by a connection coil 174; the circular coil has a relatively small radius to reduce the area of opposing portions between the circular coil and the serpentine coil.

With respect to claims 9-11 and 27, note in the apparatus of Howald et al. modified by Wang et al. or Okumura et al., the serpentine coil of has a zigzag pattern with equally spaced several sections, the serpentine coil has a plurality of outer portions extending along the circumference and a plurality of inner portions bent toward the center portion, and the serpentine coil is connected to the RF power source at the end away from the circular continuous second portion and the circular continuous second portion is connected to ground at the end away from the serpentine continuous first portion. Furthermore, the inner and outer portions of the serpentine coil are arranged to correspond to center and edge portions of the chamber, respectively.

With respect to claims 13-14, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the apparatus of Wang et al. as to have the coil in the desired shape because the configuration of the claimed coils is a matter of choice which a person of ordinary skill in the art would have found obvious absent persuasive evidence that the particular configuration of the claimed coils is significant.

Claims 15-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Howald et al., US 2004/0124779 in view of Wang et al., US 2003/0111181 or Okumura et al., US 6,177,646, as applied to claims 1-3, 9-14, 25, and 27-32 above, and further in view of Hemker et al., US 2004/0011467 or Bailey, III et al., US 2003/0010454.

Howald et al., Wang et al. and Okumura et al. are applied as above but do not expressly disclose the claimed magnetic configuration. Hemker et al. discloses a plurality of permanent magnets 132 arranged around the outer wall of the reaction chamber, wherein their north and south poles alternate, they are arranged in a region where the magnitude of a magnetic field generated by the antenna is relatively weak, and the magnets can revolve simultaneously about a central axis of the reaction chamber to shift their positions (see figs. 1-6c and their descriptions). Alternatively, Bailey, III et al. also discloses the claimed structure (see figs. 2, 3A-4, and 6 and their descriptions). In view of these disclosures, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Howald et al. modified by Wang et al. or Okumura et al. so as to comprise the magnet

revolving structure of Hemker et al. or Bailey, III et al. because such a magnetic configuration allows for modification of the plasma as well as allowing the plasma to be better confined to the processing region.

Claims 19-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Howald et al., US 2004/0124779 in view of Wang et al., US 2003/0111181 or Okumura et al., US 6,177,646, as applied to claims 1-3, 9-14, 25, and 27-32 above, and further in view of Kwon et al., U.S. Patent 6,653,988 or Chen et al., US 6,164,241.

Howald et al., Wang et al. or Okumura et al. are applied as above but do not expressly disclose a matching network connected between the radio frequency power source and the antenna and a capacitor connected between the matching network and the antenna, in parallel with the antenna, wherein the plurality of coils are connected in series to the radio frequency power source, and wherein at least one of the coils is connected in parallel to the RF source. Kwon et al. discloses a capacitor C3 connected between a matching network 120 and the antenna, in parallel with the other branch from the power supply connecting with the antenna, wherein the plurality of coils are connected in series to the radio frequency power source 110, and wherein at least one of the coils is connected in parallel to the RF source (see fig. 2a and its description). Furthermore, Chen et al. discloses a matching network 320 connected between a radio frequency power source 310 and the antenna 1 and a capacitor C1 connected between the matching network and the antenna, in parallel with the antenna, wherein the plurality of coils are connected in series to the radio frequency power source, and wherein at

least one of the coils is connected in parallel to the RF source (see, for example, fig. 3 and its description. Therefore, in view of these disclosures, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Howald et al. modified by Wang et al. or Okumura et al. so as to comprise the matching network/rf power source/capacitor/antenna structure of Kwon et al. or Chen et al. because in such a way a suitable parallel resonance antenna can be operated.

Claims 1-3, 9-14, 19-21, 25, and 27-32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chen et al., US 6,164,241 in view of Wang et al., US 2003/0111181 or Okumura et al., US 6,177,646.

Chen et al. shows the invention substantially as claimed including an inductively coupled plasma generating apparatus comprising: an evacuated reaction chamber; an antenna installed at an upper portion of the reaction chamber to induce an electric field for ionizing reaction gas supplied into the reaction chamber and generating plasma; and a radio frequency power source connected to the antenna to apply radio frequency power to the antenna, wherein the antenna comprises a plurality of coils comprising a first coil 2 and a second continuous circular coil 1 wherein the first coil surrounds the circular coil, (see, for example, fig. 3 and its description).

Chen et al. does not expressly disclose that the first coil is a serpentine coil bent in a zigzag pattern. Wang et al. disclose an inductive coupled plasma apparatus in which a serpentine coil is bent is a zigzag pattern (see, for example, figs. 1-2, 5-10, and

their descriptions). Additionally, Okumura et al. disclose an inductive coupled plasma apparatus in which a serpentine coil is bent is a zigzag pattern (see, for example, figs. 3, 14-16 and 21, and their descriptions). Therefore, in view of these disclosures, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the apparatus of Chen et al. as to comprise a serpentine coil bent in a zigzag pattern because such coil is used and known to be suitable for generating uniform plasma in an inductive plasma apparatus. Furthermore, the configuration of the claimed serpentine coil is a matter of choice which a person of ordinary skill in the art would have found obvious absent persuasive evidence that the particular configuration of the claimed serpentine coil is significant.

With respect to claims 2-3 and 12, the circular coil is arranged at a center portion of the antenna and the serpentine coil is arranged around and connected to the circular coil by a connection coil; the circular coil has a relatively small radius to reduce the area of opposing portions between the circular coil and the serpentine coil.

With respect to claims 9-11 and 27, note in the apparatus of Chen et al. modified by Wang et al. or Okumura et al., the serpentine coil of has a zigzag pattern with equally spaced several sections, the serpentine coil has a plurality of outer portions extending along the circumference and a plurality of inner portions bent toward the center portion, and the serpentine coil is connected to the RF power source at the end away from the circular continuous second portion and the circular continuous second portion is connected to ground at the end away from the serpentine continuous first portion.

Furthermore, the inner and outer portions of the serpentine coil are arranged to correspond to center and edge portions of the chamber, respectively.

With respect to claims 13-14, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the apparatus of Wang et al. as to have the coil in the desired shape because the configuration of the claimed coils is a matter of choice which a person of ordinary skill in the art would have found obvious absent persuasive evidence that the particular configuration of the claimed coils is significant.

Concerning claims 19-21, note that Chen et al. discloses a matching network 320 connected between a radio frequency power source 310 and the antenna 1 and a capacitor C1 connected between the matching network and the antenna, in parallel with the antenna, wherein the plurality of coils are connected in series to the radio frequency power source, and wherein at least one of the coils is connected in parallel to the RF source.

Claims 15-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chen et al., US 6,164,241 in view of Wang et al., US 2003/0111181 or Okumura et al., US 6,177,646, as applied to claims 1-3, 9-14, 19-21, 25, and 27-32 above, and further in view of Hemker et al., US 2004/0011467 or Bailey, III et al., US 2003/0010454.

Chen et al., Wang et al. and Okumura et al. are applied as above but do not expressly disclose the claimed magnetic configuration. Hemker et al. discloses a plurality of permanent magnets 132 arranged around the outer wall of the reaction

chamber, wherein their north and south poles alternate, they are arranged in a region where the magnitude of a magnetic field generated by the antenna is relatively weak, and the magnets can revolve simultaneously about a central axis of the reaction chamber to shift their positions (see figs. 1-6c and their descriptions). Alternatively, Bailey, III et al. also discloses the claimed structure (see figs. 2, 3A-4, and 6 and their descriptions). In view of these disclosures, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Chen et al. modified by Wang et al. or Okumura et al. so as to comprise the magnet revolving structure of Hemker et al. or Bailey, III et al. because such a magnetic configuration allows for modification of the plasma as well as allowing the plasma to be better confined to the processing region.

Response to Arguments

Applicant's arguments with respect to claims 1-3, 9-21, 25, and 27-32 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Luz L. Alejandro whose telephone number is 571-272-1430. The examiner can normally be reached on Monday to Thursday from 7:30 to 6:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on 571-272-1435. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Luz L. Alejandro
Primary Examiner
Art Unit 1763

July 24, 2006